National Transportation Safety Board

Investigative Update of Battery Fire Japan Airlines B-787 - Jan 7, 2013

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Chairman

January 24, 2013

NTSB

Timeline – JAL Battery Incident

- 10:06am - aircraft arrived at gate in Boston from Narita, Japan
  - 183 passengers and 11 crew deplaned
- 10:32am - Cleaning and maintenance crew noticed smoke in cabin
- 10:35am - Mechanic noted flames coming from APU battery in aft electronics bay

Timeline, cont.

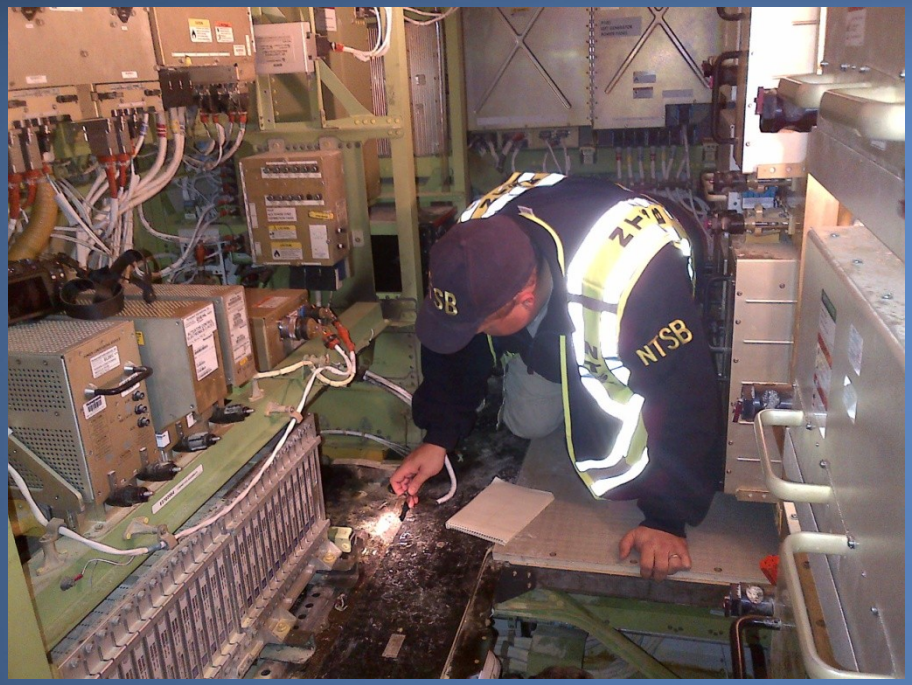
- 10:37am – Airport Rescue & Fire Fighting notified
- 10:40am – Fire and rescue personnel arrive on scene
- 12:19pm – Fire and rescue personnel report event was “controlled”

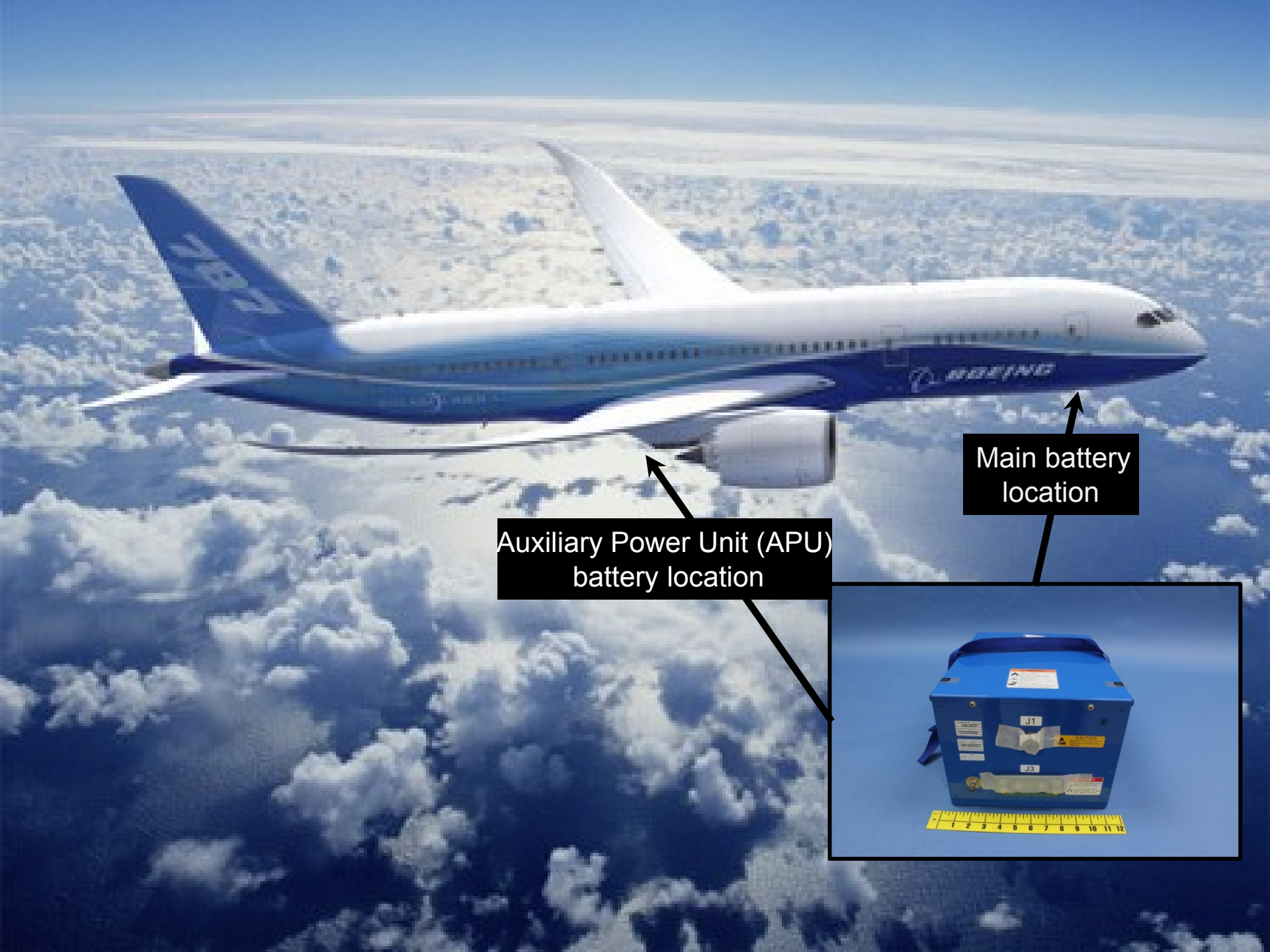
APU Battery

Exemplar Battery

JAL Event Battery

Damage to Aft Electronics Bay

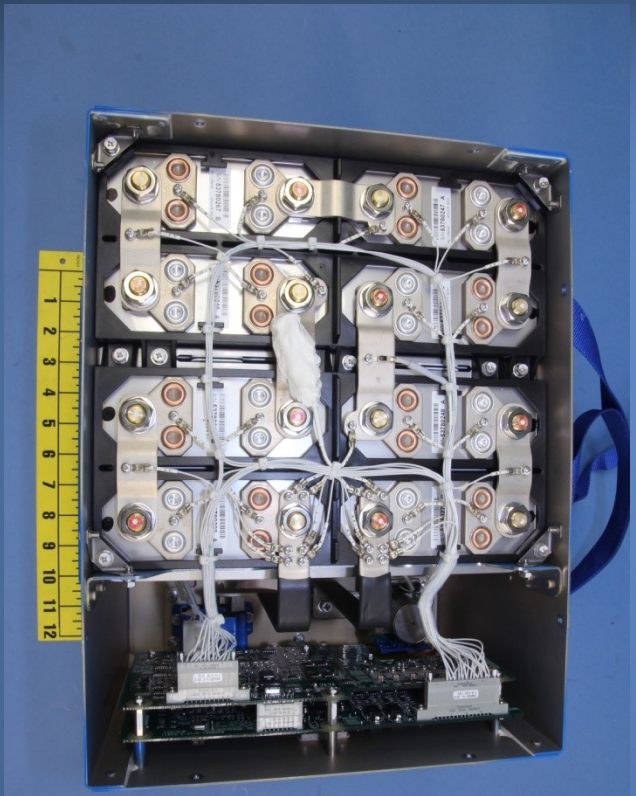



Main battery location
Auxiliary Power Unit (APU) battery location
J1
J3

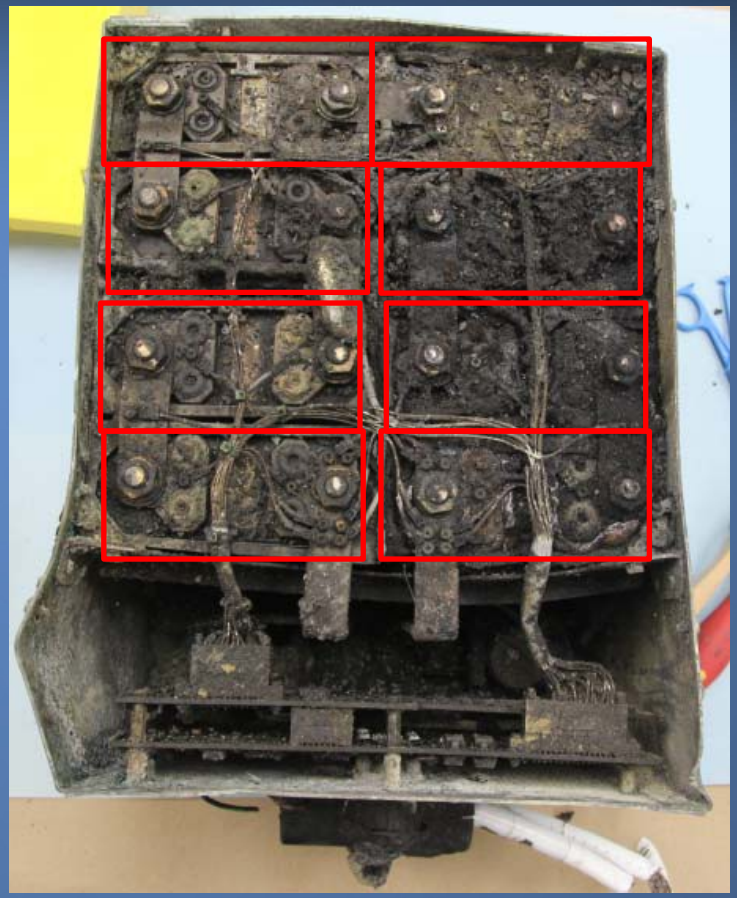
Investigative Activities

- Battery exam and teardown at NTSB Materials Laboratory
- Component exam and teardown
  - Tucson, AZ – Battery Charger Unit and Start Power Unit (Securaplane Technologies)
  - Phoenix, AZ – APU Controller (United Technology Aerospace Systems)
  - Seattle, WA – Two General Purpose Modules (Boeing Commercial Airplanes)
  - Fujisawa, Japan – Battery Monitoring Unit (Kanto Aircraft Instrument)

JAL APU Battery Cells



Exemplar Battery

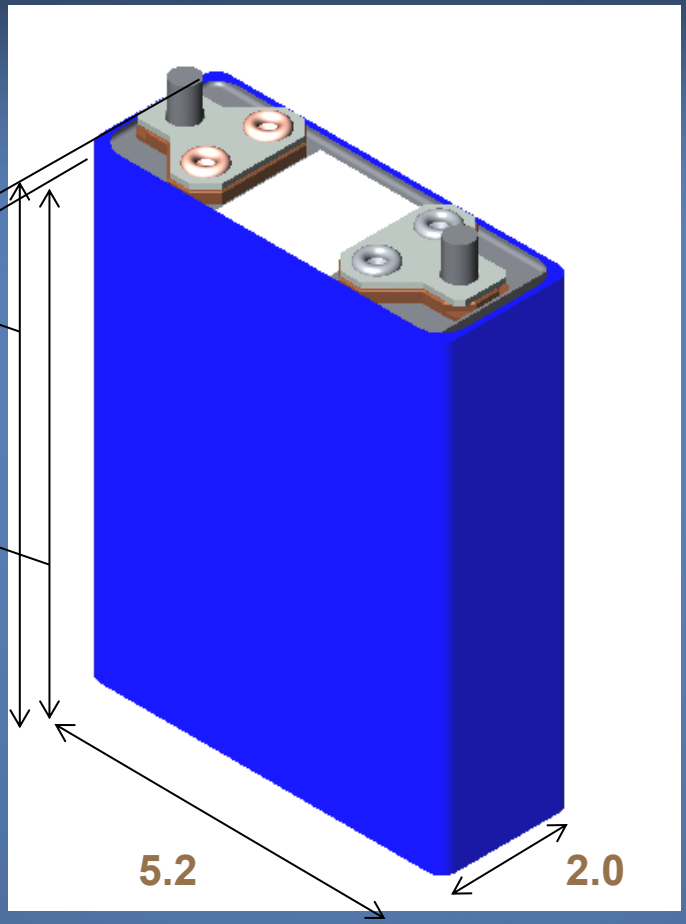


JAL Event Battery

Cell and Battery Specifications

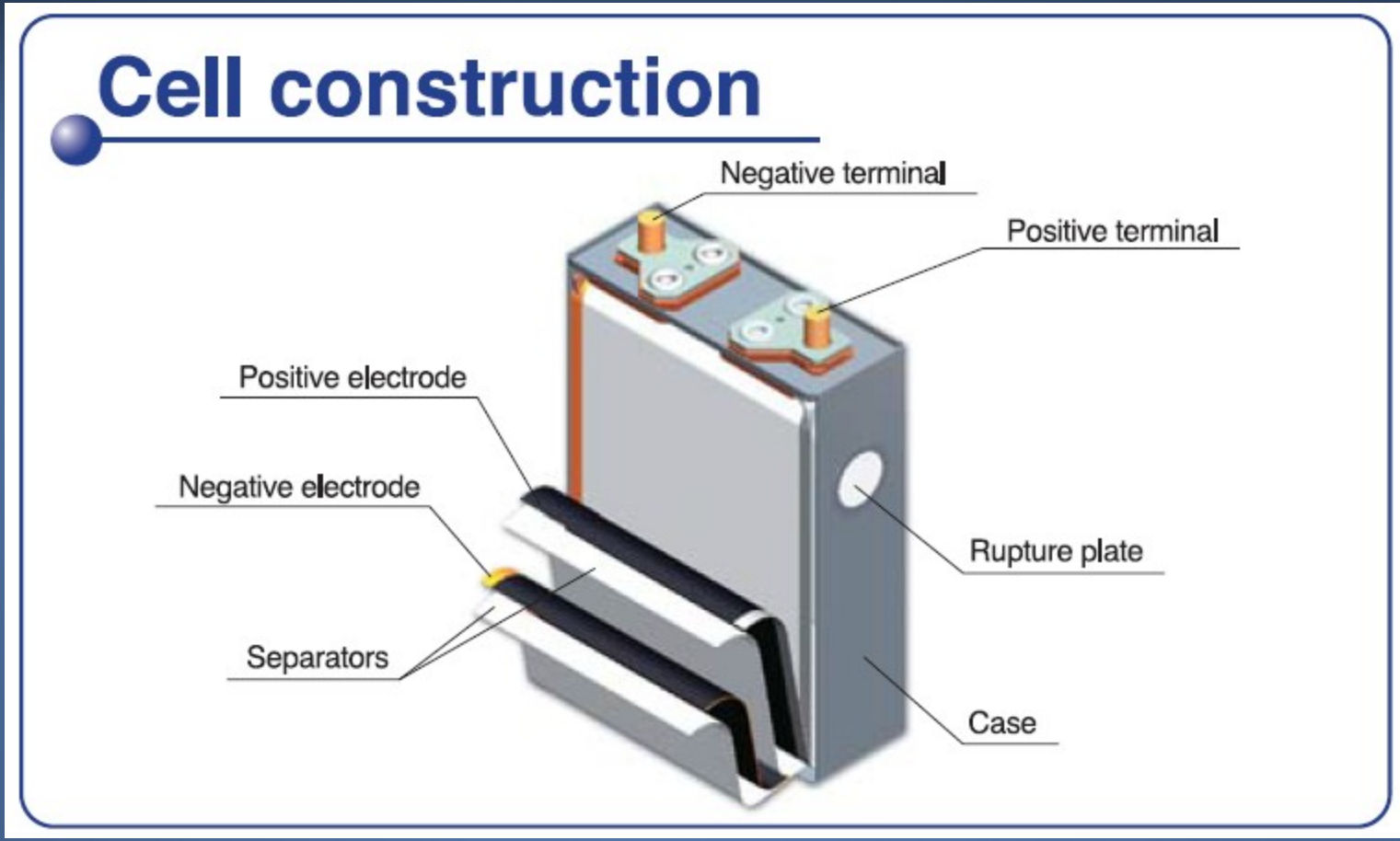
		Cell	Battery
Nominal capacity (Ah)		75	75
Nominal voltage		3.7	29.6
Operational voltage range (V)		2.5 – 4.025	20 – 32.2
Weight (lb.)		6.0	63
Dimensions (in.)			
	W	5.2	10.9
	D	2.0	14.2
	H	7.7	8.5

Cell Design

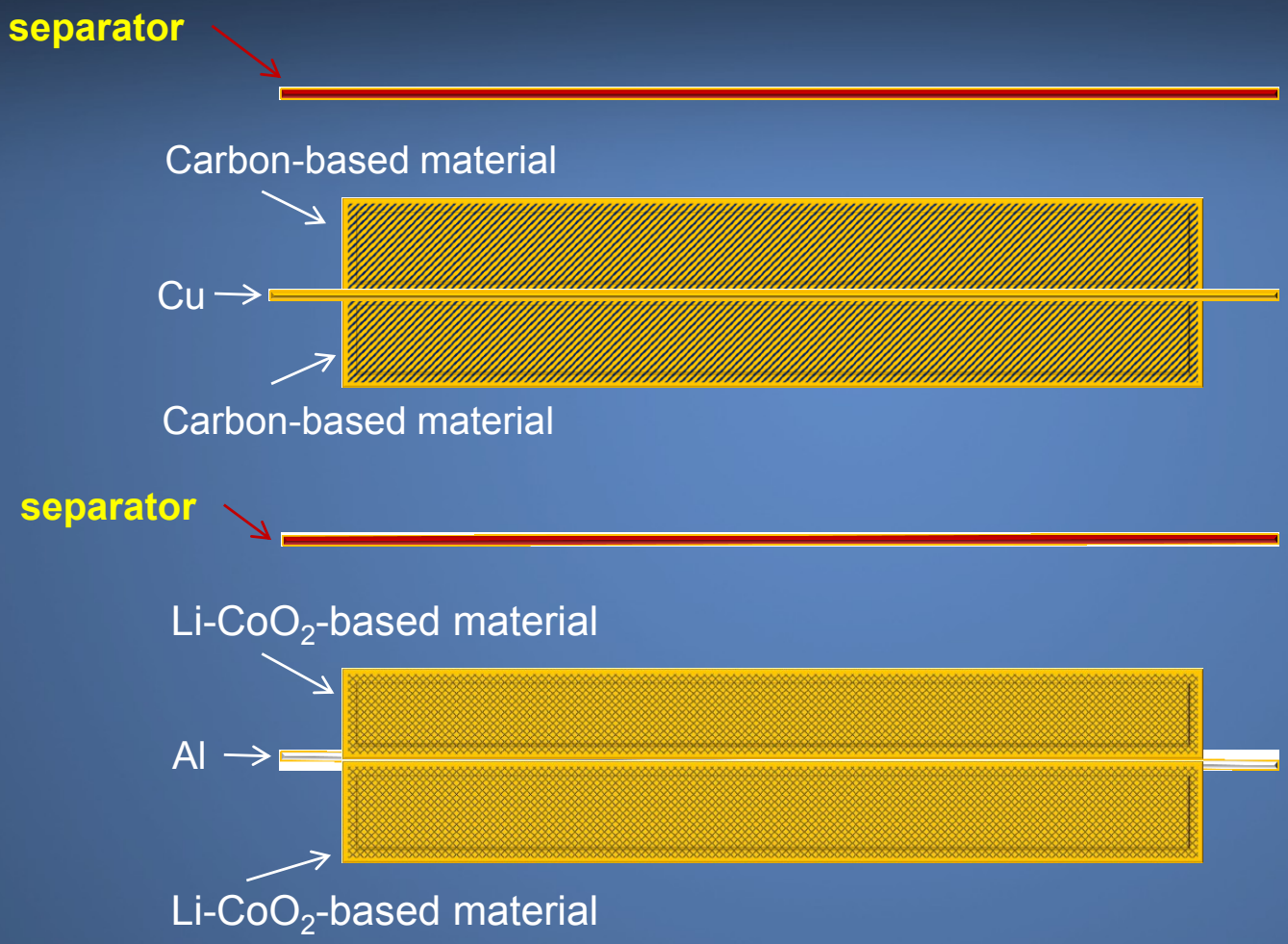


(Unit : inch)

Electrodes


Cell construction
Negative terminal
Positive terminal
Positive electrode
Negative electrode
Rupture plate
Separators
Case

Electrode Construction



Not to scale

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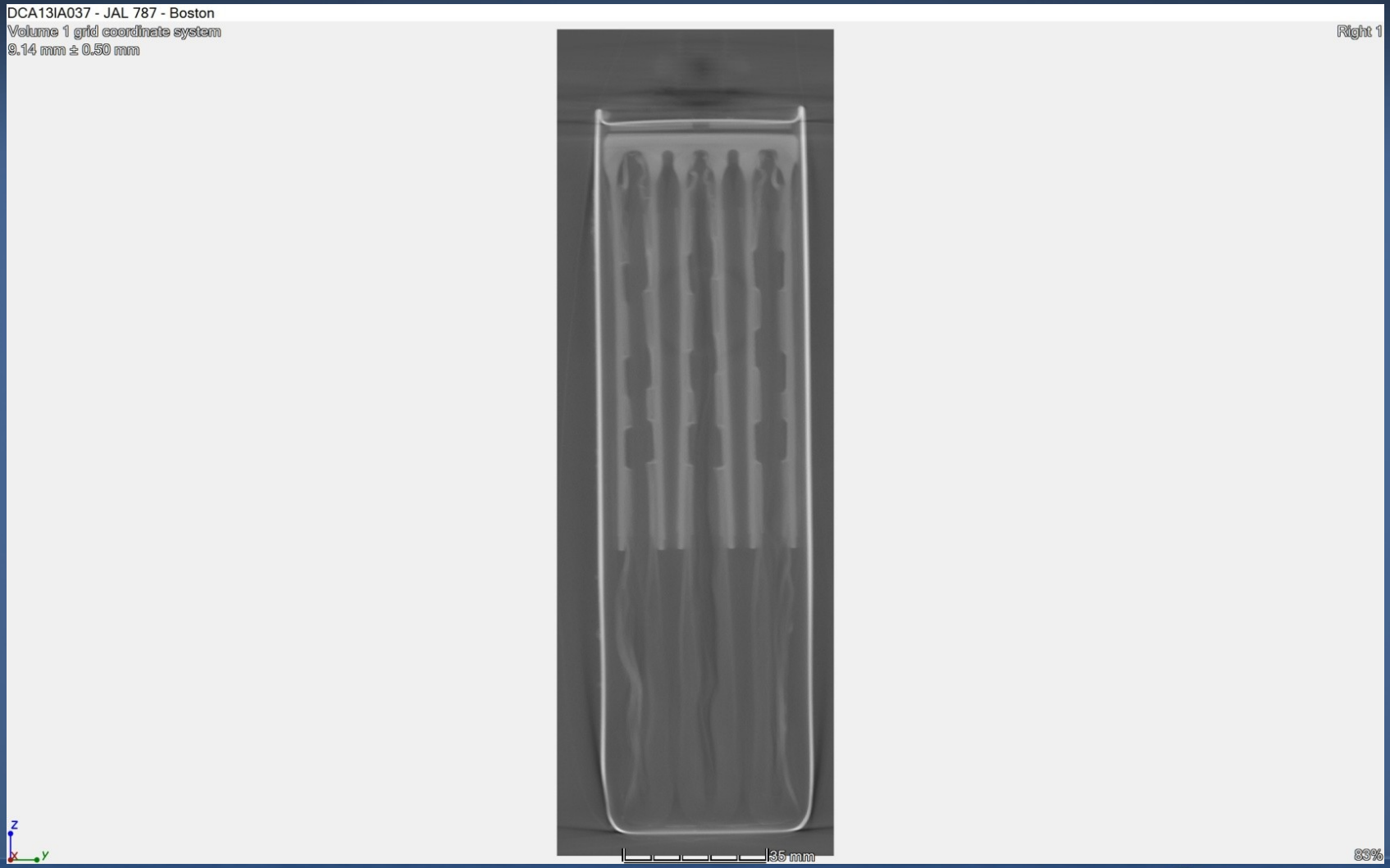
Example of a Cell CT Scan



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NTSB Lab Activities

Cell Examinations To Date

SEM – Scanning Electron Microscopy

EDS – Energy Dispersive Spectroscopy

• CT scan of entire assembly			
8	• disassembled	• CT scan	1
7	• CT scan • disassembled • SEM	• disassembled	2
6	• CT scan • disassembled	• CT scan	3
5	• CT scan • disassembled • SEM • EDS	• CT scan	4

We Are Looking For:

- Signs of thermal runaway
- Signs of electrical short circuiting
- Manufacturing defects
- “Anything unusual”

Damaged Electrode - Internal Short Circuit

Hole

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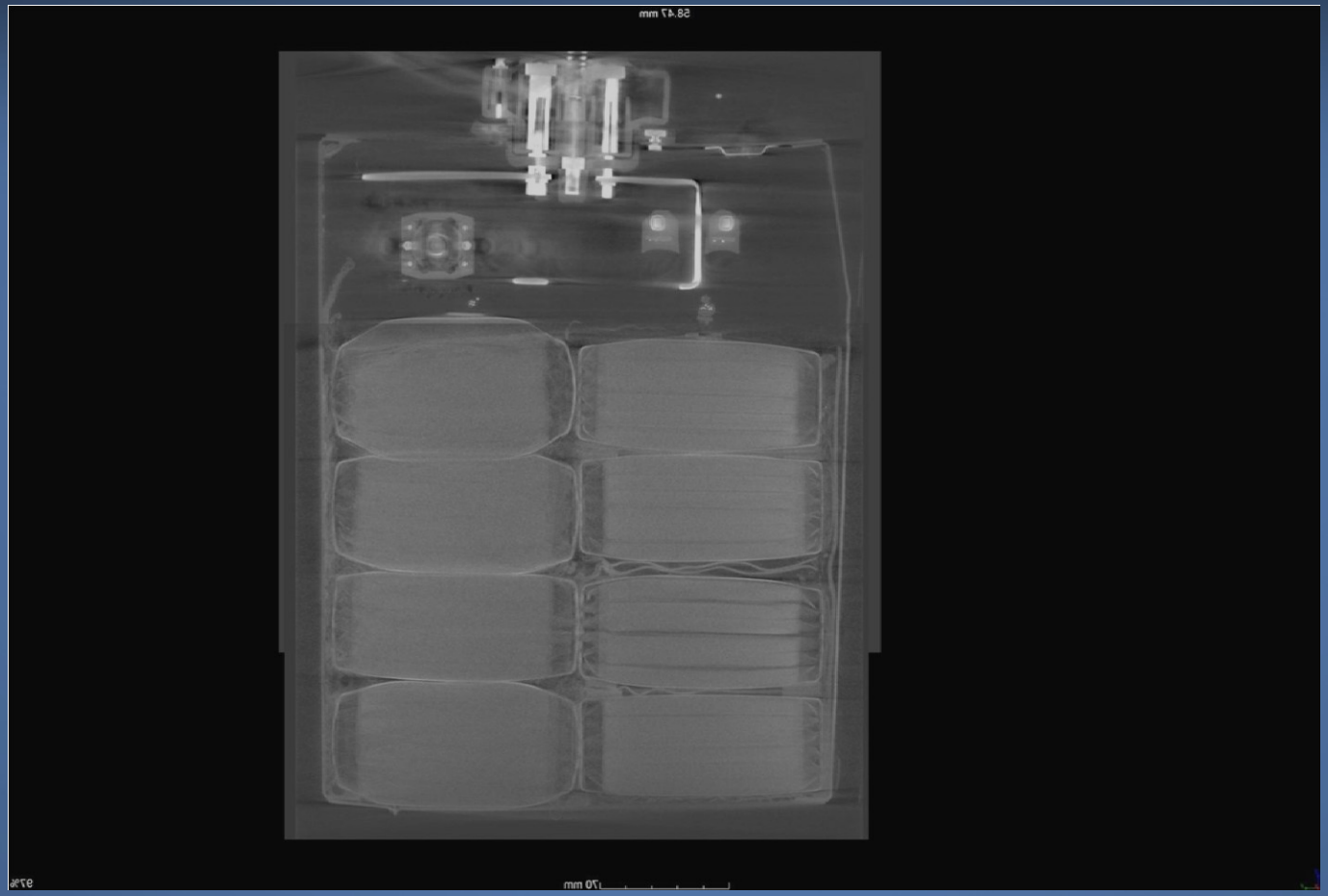
Cell 6 CT Scan

CT Scan of Battery



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Findings To Date

- Fire was present
- Signs of thermal runaway
- Signs of electrical short circuiting

Next Steps

- Complete the in-house laboratory examinations
- Conduct examinations and testing of exemplar batteries
- Synthesize lab examination findings with fire forensics and aviation systems investigation

Parties to Investigation

- Federal Aviation Administration
- Boeing Commercial Airplanes
- Accredited Representatives
  - Japan – JTSB
    - GS Yuasa
    - Japan Airlines
  - France – BEA
    - Thales Avionics Electrical Systems
- Technical assistance provided by Carderock Division, Naval Surface Warfare Center

JTSB Investigation
ANA Battery Event

Photo by *Reuters/Kyodo/Landov*

National Transportation Safety Board

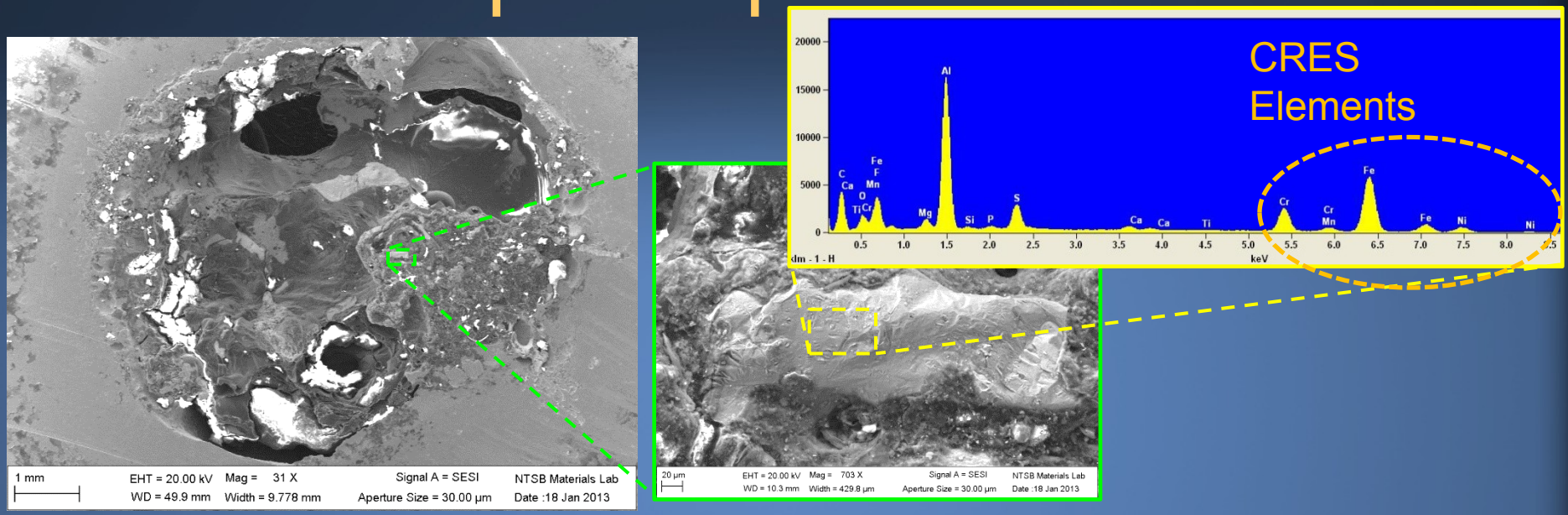
ANA – Smoke Vented During Flight

Battery Case “Anomaly”

Viewed From Outside
(Post-clean)

Viewed From Inside
(Post-clean)

Microscopic Inspection – Inside



- Finding: electrical arc between battery cell and inside of battery case
- Not believed to be initiating event

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